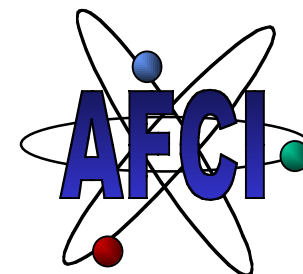
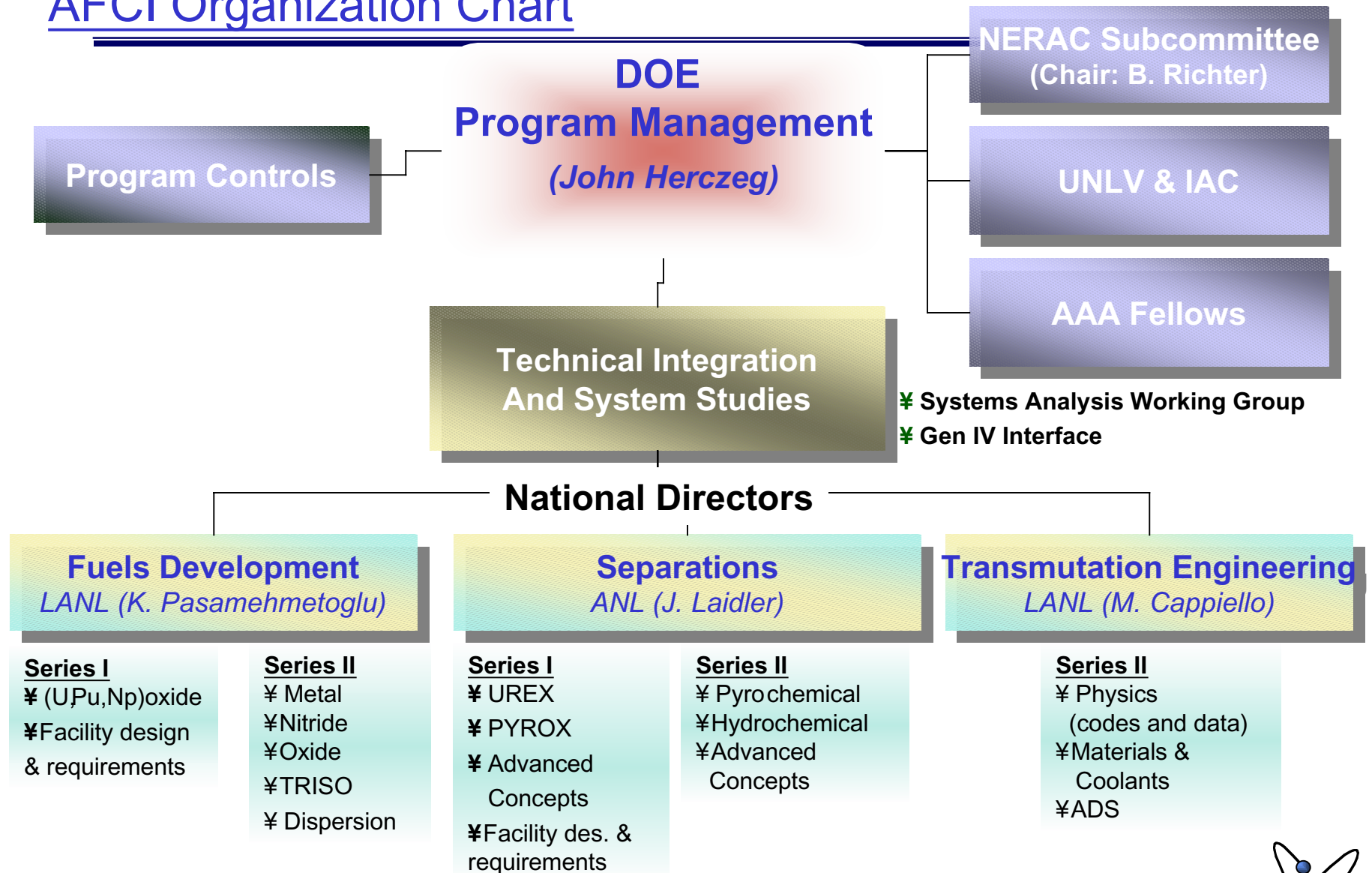


*Advanced Fuel Cycle Initiative  
(AFCI)  
Five Year Program Plan*

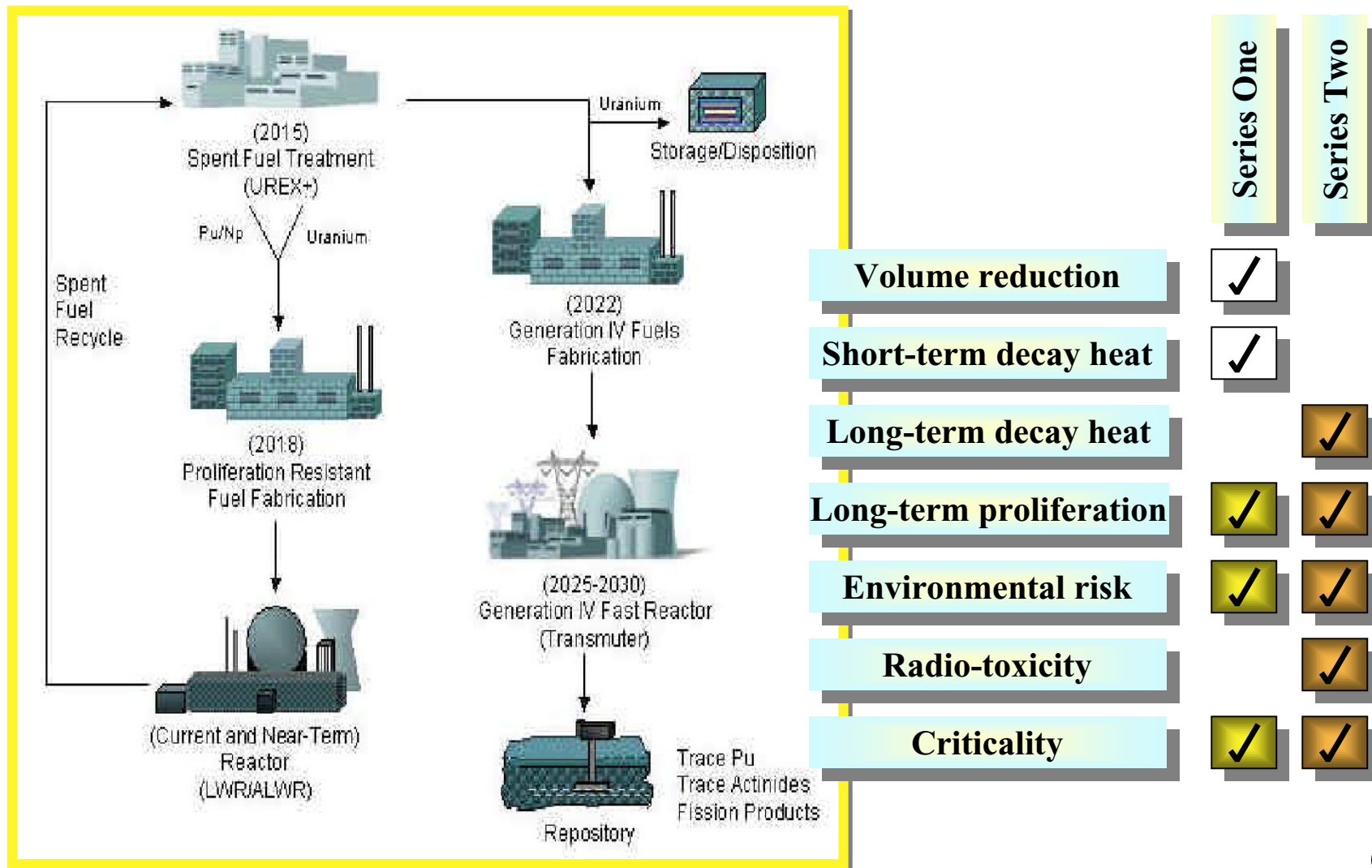
*Kemal O. Pasamehmetoglu  
AFC Fuels Development  
National Technical Director  
Los Alamos National Laboratory*



# AFCI Organization Chart



# *The Fuel Development Program Addresses Both Series One and Two Fuels Needs for the AFCI*



# ***Fuel Development Program Supports the Short-term and Long-term Goals and Objectives of the AFCI***

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- ¥ **Develop proliferation-resistant Pu - U oxide fuels that can be used in existing LWRs and ALWRs soon after 2015**

## **SERIES ONE**

- ¥ **By FY2007, complete**

- Fuel fabrication process definition
- Fuel specifications
- Performance data-package

**by**

- Irradiation testing
- Analyses
- Comparison to MOX data-base
- International collaborations

- ¥ **Develop Pu - MA -U? bearing fuels that can be used in existing fast spectrum transmutation systems to be deployed ~ 2030**

- ¥ **By FY2007, determine feasible fuel options consistent with selected transmutation implementation scenario, by**

- Irradiation testing
- Analyses

## **SERIES TWO**

- ¥ **By 2010, select final fuel form for the decided implementation scenario**



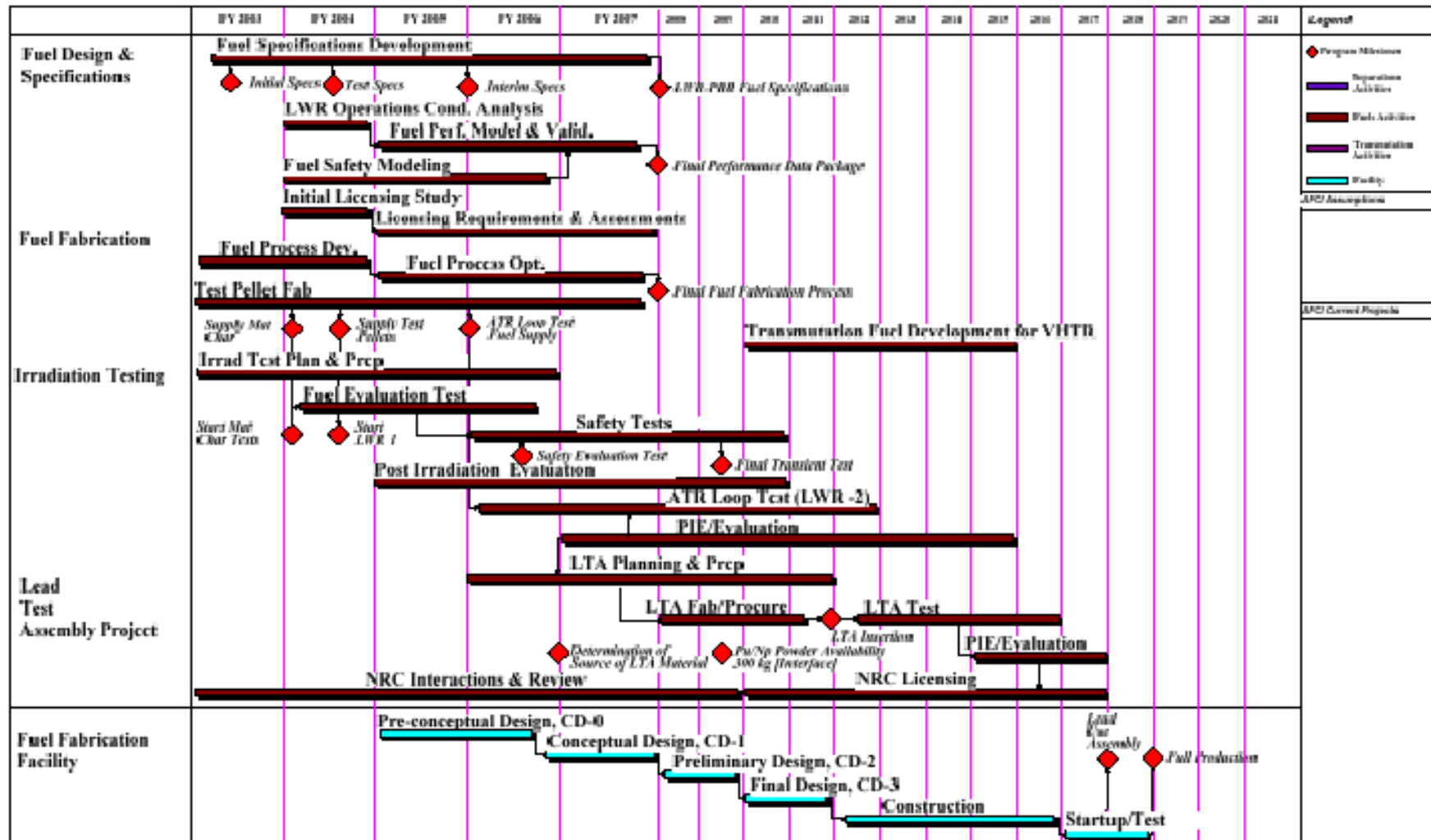
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# ***SERIES ONE***

## ***FUEL DEVELOPMENT***

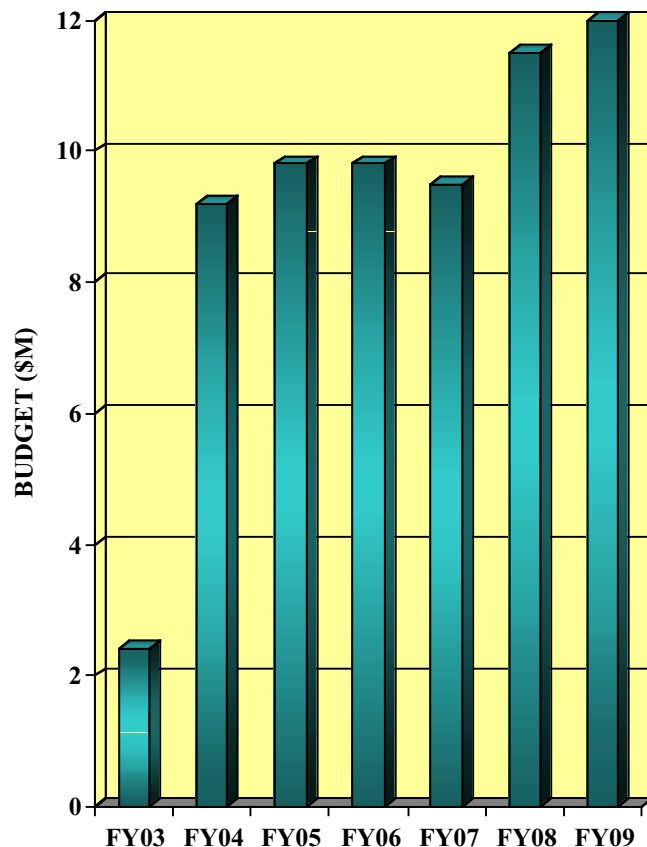
**Proliferation-resistant Plutonium-Uranium Oxide  
fuels for LWRs and ALWRs**

# Top-level Deployment Schedule is Driven by Series One Fuel Development



# *Five-Year Budget is Estimated to Achieve the Series One Deployment Objectives*

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**In addition to fuel fabrication and ATR testing, the budget contains the following:**

- Pre-conceptual and conceptual design for the fuel fabrication facility
- LTA planning and preparation
- International collaboration to assess the MOX databases and Np bearing fuel testing
- HFIR tests if additional testing is needed
- Use of ACRR or TREAT for transient safety testing

## ***There are a Number of Critical Issues That Must be Addressed During Series One Implementation***

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- ¥ **Schedule is very aggressive and success oriented**
  - Early definition of proliferation resistant fuel
  - Early involvement of industry and NRC
  - Early definition of licensing requirements
  
- ¥ **Irradiation test facilities exist**
  - Aggressive test and PIE scheduling requires timely availability of facilities
  
- ¥ **If NRC requires detailed transient testing, TREAT or another transient test facility could be restarted.**
  
- ¥ **A fuel composition close to standard MOX will accelerate development**
  - Early assessment of International MOX database in comparison with the Series One proliferation resistant fuel composition



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## ***SERIES TWO***

## ***FUEL DEVELOPMENT***

**MA bearing transmutation fuels to be used in  
fast-spectrum transmuters (ADS, GEN IV)  
Advanced high-burnup fuels for GEN IV reactors**

Fertile-free fuel

¥ADS  
¥Fast reactors with  
inhomogeneous core

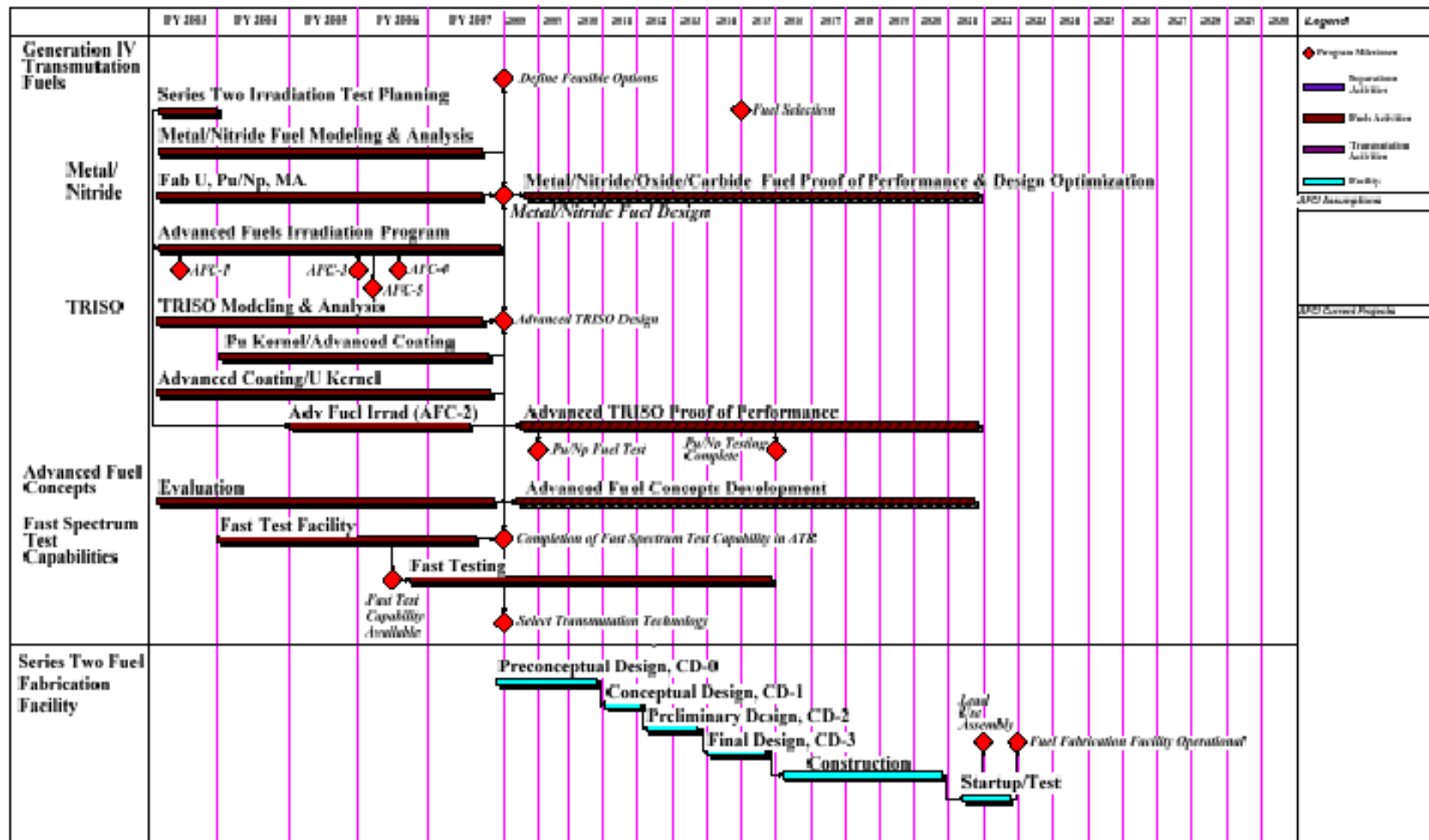
TRU-Rich fuel

¥Fast reactors with  
low conversion ratio

Fertile-rich fuel

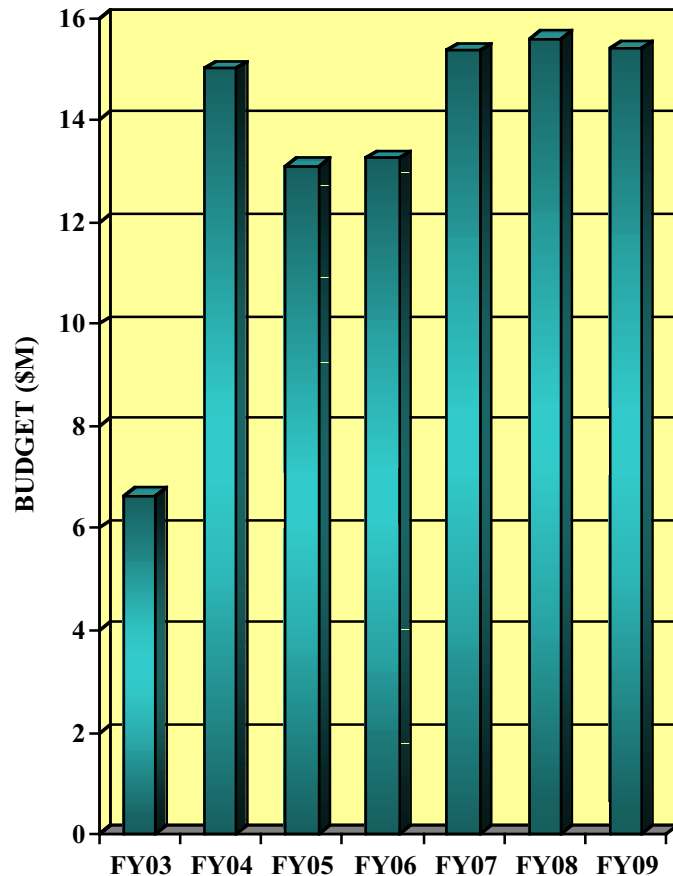
¥high-burnup  
equilibrium fuel cycle  
(GEN-IV)

## *Top-Level Deployment Schedule is Driven by Series Two Implementation Scenario and Technology Selection Decisions*



## *Five-Year Budget is Estimated to Achieve the Series Two Research Objectives and Data for Selection Studies*

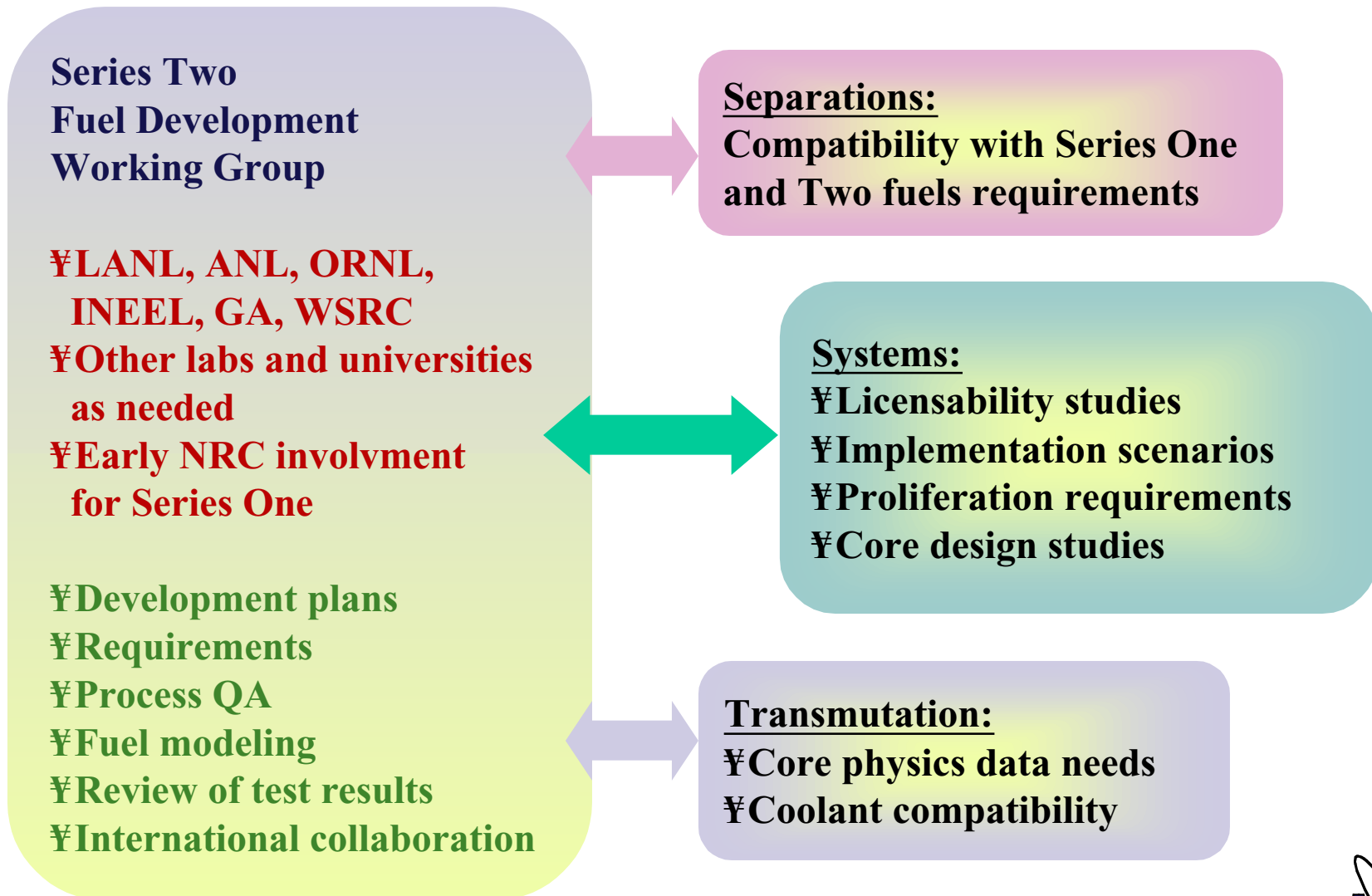
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- ¥ Fabrication and testing of nitride, metallic, TRISO and one selected form of dispersion fuel for 5-6 years.
- ¥ Development of a fast-flux irradiation test facility in ATR.
  - LANSCE facility is not in this budget
- ¥ TRISO fuel development could be supported by multiple programs.
- ¥ Specific GEN IV fuel development is not included in this estimate, at this time.

## *Series One and Two Fuel Research Effort will be Coordinated Through a Multi-Institutional Working Group*

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## ***Series Two Fuel Research will Continue in the Next Five Years and Prepare Data for Selection Studies***

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- ⌘ **Longer development time needed because fuels containing MA have not been developed before**
- ⌘ **Strong International collaboration is essential in developing an adequate data-base for selection studies**
- ⌘ **Major issue is the availability of a domestic fast-flux irradiation capability to test high-burnup fuels**
- ⌘ **Fuel compositions of interest are very strongly dependent on the implementation scenarios, especially the outcome of the front end Series One scenario**
- ⌘ **A stronger integration with GEN IV fuel needs will be achieved early in the AFCI program (mostly in FY 2003)**



# *Modeling is expected to provide input to selection studies*

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- ¥ **Testing and PIE of multiple forms of high-burnup fuels is expensive**
  - A comprehensive selection based on testing only is not feasible during the early phases of the research.
  - Facilities are limited (specifically fast spectrum test facilities)
  - Difficult to perform prototypic tests (flux & spectrum effects)
- ¥ **Even though modeling may not be predictive, fidelity of comparative studies will be very valuable.**
- ¥ **Modeling must focus on both fabrication and performance.**
- ¥ **For ADS, the effect of high-energy tail in neutron spectrum must be addressed for both the fuel and the clad performance**

